



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Letter to the Editor

Elite athletes maintain peak performance after testing positive for SARS-CoV-2



Keywords:

COVID-19

Fitness

Preventive medicine

Public health

Physical activity

Sports performance

The coronavirus disease 2019 (COVID-19) was declared a pandemic on the 11th of March 2020. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has to date resulted in more than 200 million cases and more than four million deaths. Part of the initial response to the pandemic included pausing professional sporting activities. After a few months of hiatus, sporting activities resumed throughout the world, initially without the presence of fans who were later reintroduced at a restricted capacity. To ensure a safe return-to-play, the effects of SARS-CoV-2 infections on elite athletes were carefully monitored.

In October 2020, it was revealed that some of the athletes who contracted SARS-CoV-2 were experiencing persistent and residual symptoms, such as cough, tachycardia and extreme fatigue, several weeks to months after the initial infection.¹ This prompted major professional sporting leagues in the US to implement mandatory cardiac screening for players who had tested positive for SARS-CoV-2, prior to clearing them for resumption of sporting activities. Screening of 789 asymptomatic (58.3%) and symptomatic (41.7%) athletes identified 5 cases (0.6%) with inflammatory heart disease, who were advised to not participate in professional sporting activities.² The athletes who were cleared to resume professional sport participation did not exhibit any adverse effects.² Another study reported a 2.3% prevalence of clinical and subclinical myocarditis among 1597 competitive athletes from US colleges recovering from COVID-19.³ The long-term implications of myocarditis in athletes recovering from COVID-19 are not yet known.

Several elite professional athletes tested positive for SARS-CoV-2.⁴ All of the elite athletes reportedly recovered successfully and their performance did not seem to be affected after contracting SARS-CoV-2. In fact, some of these athletes recorded peak performances following the infections, with examples found across all types of sports.

A plethora of National Basketball Association (NBA) players tested positive for SARS-CoV-2 and recorded historic performances. Notable examples include Nikola Jokic who won the award of the “most valuable player” and Rudy Gobert who won the “defensive player of the year” award in 2021. Russell Westbrook managed to break the all-time NBA record for the most triple doubles (i.e. recording double digits in points, rebounds and assists) in 2021. Donovan Mitchell and Kevin Durant recorded historic performances during the NBA play-offs in 2020 and 2021 respectively.^{5,6} Jason Tatum matched the scoring record of legendary player Larry Bird, five months after contracting SARS-CoV-2 and despite reporting experiencing lingering shortness of breath.⁷ Chris Paul

led his team to its first victory in the 2021 NBA finals, just two weeks after testing positive for SARS-CoV-2.⁸

These observations extend to other sports. Famous football player Chistiano Ronaldo tested positive for SARS-CoV-2 on multiple occasions yet his performance not only was not affected, but he continued to climb the record books in his sport by becoming the top goal scorer in the history of football. Renowned tennis player Novak Djokovic won the Australian open just a few months after contracting SARS-CoV-2 in 2020 and is en route to winning all “Grand slam” tournaments in 2021, having already won the Australian open, the Roland Garros and the Wimbledon tournaments this year. Formula 1 driver Lewis Hamilton won the championship in 2020, despite having to miss a race after contracting SARS-CoV-2.

There are numerous other examples of elite athletes recording peak performances shortly following as well as several months after testing positive for SARS-CoV-2, indicating no decline in athletic performance indices such as acceleration, endurance or reaction rate and therefore suggesting no serious adverse effects of SARS-CoV-2 on the anaerobic and aerobic capacity and the nervous system of these athletes, as it has been previously reported in other populations.^{9,10} Although the reasons for the absence of these adverse effects are not known with certainty, the protective effects of physical activity in reducing the risk of adverse effects from SARS-CoV-2 infections have been described.¹¹ In addition to the health benefits active people experience, physical activity appears to confer protection for many years following its cessation, with people who had better cardiorespiratory fitness and muscular strength at a younger age being at reduced risk of adverse outcomes from SARS-CoV-2 infections in later life.¹²

The association of physical activity with reduced morbidity from COVID-19 is independent of the body mass index.¹² However, obesity has been reported as the strongest risk factor for morbidity and mortality from COVID-19.¹³ Therefore, another reason for the ability of athletes to maintain peak performance following infection with SARS-CoV-2 may be their favourable body composition. Even the athletes who have higher body fat stores, exhibit a healthier fat distribution compared to people who are not physically active. Athletes store their fat mostly intramuscularly and within the superficial compartment of the subcutaneous adipose tissue, both of which are healthier reserves than the visceral and the deep subcutaneous tissue stores, where inactive people tend to store their fat.¹⁴ Therefore, even the athletes with higher body fat do not in general manifest the chronic inflammation and insulin resistance that characterises a plethora of inactive people with obesity, and thus their immune system is not affected in the same manner by the extra adipose tissue as it is in people with the same adiposity that are not active.¹⁵

The resistance of elite athletes to serious adverse outcomes with SARS-CoV-2, and their ability to sustain peak performance both in the short- and long-term post infection, further emphasises the importance of performing regular physical activity and maintaining a favourable body composition and overall fitness for health and wellbeing.^{15,16} COVID-19 has exposed how unhealthy we have become as a species, with most adverse outcomes seen in people with obesity and its

associated comorbidities of diabetes and hypertension.¹³ Overweight and obesity affect more than 2 billion people around the world, and they are largely results of modern lifestyles. In the quest for convenience, consumption of processed foods and calorie-dense nutrient-poor foods, such as most take-away foods, keeps increasing. Physical activity rates drop and the decline is predicted to accelerate. From the homo erectus walking on two legs, to the Botai people riding horses, to the first commercial cars being deployed at the beginning of the last century that required muscular strength to change a gear, and soon to travelling in driverless cars that don't even require us to use a steering wheel, we are embracing a life that minimises movement and activity. "Alexa" can now turn on the lights at home on demand, and soon there will be an infinitesimal need for incidental activity. Technological advancements are great and have improved many aspects of life, however health does not come at the press of a button. The UK government is now planning to offer incentives for leading a healthy lifestyle, in an effort to reduce obesity and to promote healthy eating and participating in physical activity.¹⁷ Governments throughout the world must invest in public health initiatives and actions that promote leading a healthy lifestyle on a population level. Given that SARS-CoV-2, with its mutations, is here to stay for a long time, preventive medicine measures such as advocacy and incentives to be active and to eat healthy are warranted as another shield, along with vaccines, in the arsenal against SARS-CoV-2, but also to reduce the chronic burden from non-communicable diseases, for which the rising obesity pandemic is a major risk factor in addition to being the strongest risk factor for adverse outcomes from COVID-19.¹³

Funding information

The author declares no receipt of funding.

Declaration of interest statement

The author declares no conflicts of interest.

References

1. Wilson MG, Hull JH, Rogers J et al. Cardiorespiratory considerations for return-to-play in elite athletes after COVID-19 infection: a practical guide for sport and exercise medicine physicians. *Br J Sports Med* 2020;54:1157–1161.
2. Martinez MW, Tucker AM, Bloom OJ et al. Prevalence of inflammatory heart disease among professional athletes with prior COVID-19 infection who received systematic return-to-play cardiac screening. *JAMA Cardiol* 2021;6:745–752.
3. Daniels CJ, Rajpal S, Greenshields JT et al. Prevalence of clinical and subclinical myocarditis in competitive athletes with recent SARS-CoV-2 infection: results from the big ten COVID-19 cardiac registry. *JAMA Cardiol* 2021:e212065. doi:10.1001/jamacardio.2021.2065.
4. Wion. From Hamilton to Ronaldo: athletes who tested positive for COVID-19 in 2020. Available from: <https://www.wionews.com/photos/from-hamilton-to-ronaldo-athletes-who-tested-positive-for-covid-19-in-2020-352776#cristiano-ronaldo-276006>.
5. NBA.com. Donovan Mitchell's 57 points rank third in NBA single-game playoff history. Available from: <https://www.nba.com/article/2020/08/17/donovan-mitchell-third-most-points-playoff-history#:~:text=Though%20it%20wasn't%20enough,m%20in%20NBA%20postseason%20history>.
6. NBC Sports. Kevin Durant turns in all-timer, leads nets over bucks in game 5. Available from: <https://nba.nbcsports.com/2021/06/16/kevin-durant-turns-in-all-timer-leads-nets-over-bucks-in-game-5/>.
7. ESPN. Boston Celtics' Jayson Tatum scores 60 points and amazes the NBA world. Available from: https://www.espn.com.au/nba/story/_/id/31368344/boston-celtics-jayson-tatum-scores-60-points-amazes-nba-world. Accessed on July 24, 2021.
8. ESPN. Phoenix suns follow Chris Paul's lead in game 1 NBA finals win: when it's going like that, 'let him orchestrate'. Available from: https://www.espn.com.au/nba/story/_/id/31774840/phoenix-suns-follow-chris-paul-lead-game-1-nba-finals-win-going-let-orchestrate.
9. Cramer GAG, Bielecki M, Züst R et al. Reduced maximal aerobic capacity after COVID-19 in young adult recruits, Switzerland, May 2020. *Euro Surveill* 2020;25. doi:10.2807/1560-7917.ES.2020.25.36.2001542.
10. Berger JR. COVID-19 and the nervous system. *J Neurovirol* 2020;26:143–148.
11. Sallis R, Young DR, Tartof SY et al. Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients. *Br J Sports Med* 2021. doi:10.1136/bjsports-2021-104080.
12. Af Geijerstam A, Mehlig K, Börjesson M et al. Fitness, strength and severity of COVID-19: a prospective register study of 1 559 187 Swedish conscripts. *BMJ Open* 2021;11: e051316.
13. Kompaniyets L, Pennington AF, Goodman AB et al. Underlying medical conditions and severe illness among 540,667 adults hospitalized with COVID-19, March 2020–March 2021. *Prev Chronic Dis* 2021;18:E66.
14. Stefan N. Causes, consequences, and treatment of metabolically unhealthy fat distribution. *Lancet Diabetes Endocrinol* 2020;8:616–627.
15. Siopis G. The case for promoting physical activity amidst the COVID-19 pandemic. *J Sci Med Sport* 2021;24:327–328.
16. Siopis G. The case for promoting physical activity amidst the COVID-19 pandemic. An update. *J Sci Med Sport* 2021;24:900–901.
17. The Telegraph. Families could get rewards for healthy living in new war on obesity. Available from: <https://www.telegraph.co.uk/news/2021/07/23/families-could-get-rewards-healthy-living-new-war-obesity/>. Accessed on July 25, 2021.

George Siopis

School of Life and Environmental Sciences, Faculty of Science,

The University of Sydney, Australia

Charles Perkins Centre, The University of Sydney, Australia

E-mail address: gsio7745@uni.sydney.edu.au

29 July 2021